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On an Adhering Habit of a Pygmy Cuttlefish,
Idiosepius Pygmaeus Steenstrup.

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With 3 Figures in Text.

In July 1920, I captured several mature individuals of *Idiosepius pygmaeus* from the sea surface near Oshoro, where a Marine Laboratory belonging to the Hokkaido Imperial University is situated. They were brought alive to the laboratory in a basin of water with fronds of an *Ulva* grown on a pebble, which I also collected in the vicinity. They swam about at first in an ordinary manner; but as soon as the water, which had been moving from my handling, became still, they approached the sea weed, each attached itself with its back to the under surface of the fronds, and remained in this position for a long time; this attracted my special attention (Fig.

1).

While adhering, they held the arms up together and looked around, turning their head sometimes to the right, sometimes to the left, which they did as if from looking out for something. Whenever frightened by putting a pincette towards their

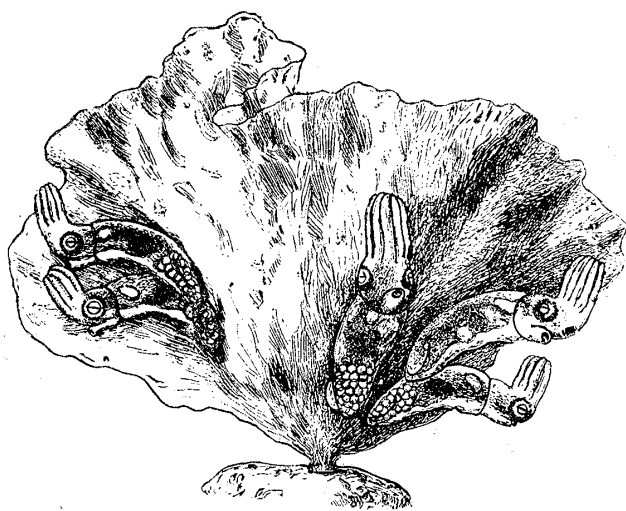


Fig. 1. *Idiosepius pygmaeus*, adhering to a frond of an *Ulva*, slightly enlarged.

eyes, they instantaneously left the plant, escaping away from the pincette to the distance. But when the pincette was removed, they again returned to the sea weed, taking shelter beneath it. Both the attaching and separating were fairly easily accomplished and always as if voluntarily. Their adhesive power was often of such a high degree that even though I moved the fronds, they persisted still in their adhesion. The experiment was repeated, in every case with the same result; this suggested to me the existence on their back of an apparatus adapted for adhesion. But no such apparatus was discernable while the animal was still living. It was after their fixation with reagents that a special structure made its appearance, which I name here "adhesive organ". It is represented by a longitudinal corrugated area extending along the posterior three-fourths of the back. The folds run quite irregularly without any definite mode of arrangement, and show also fine furrows and pits (Fig. 2). Other preserved specimens at my disposal, which have been brought from various localities also present the same structure irrespective of sex and age.

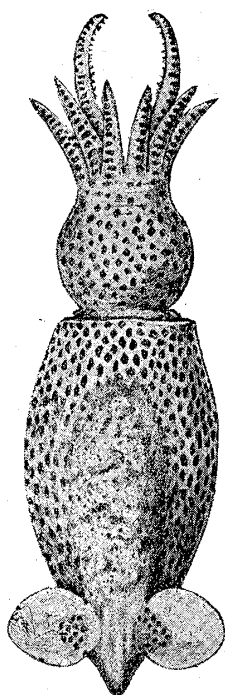


Fig. 2. *Idiosepius pygmaeus*, to show the adhesive organ on the back, $\times 3$.

An histological examination¹⁾ of the organ well suggests its mechanism. This seems to consist chiefly in the structure of the integument, the underlying tissues showing no more speciality than those of the remaining part of the mantle. The integument is sharply separated from the underlying tissues by a distinct basement membrane, and is well characterised by its great thickness which is more than double that of the ordinary integument. The external surface is quite uneven due to the presence of many notches, which correspond to the superficial furrows and pits previously pointed out (Fig. 3).

1) The sample was fixed with corrosive sublimate solution; the preparation was made by embedding in paraffin and staining with Heidenhein's hematoxyline and eosin.

The cells of the integument are of five kinds, which are enumerated thus: granular cell, goblet cell, basal cell, columnar cell, and fusiform cell.

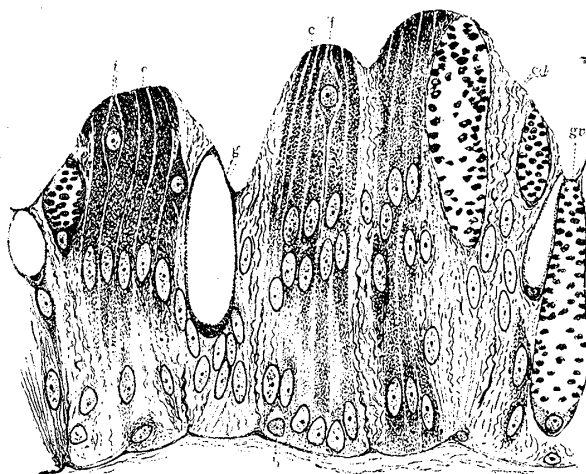


Fig. 3. Adhesive organ, cut transversely to the long axis of the animal, $\times 170$. b, basal cell; c, columnar cell; cd, decayed columnar cell; f, fusiform cell; g, goblet cell; gr, granular cell.

Of these the first two which predominate in the integument of the other part, are here relatively rare, and that they are both mucilaginous in nature, serving as a lubricant, has already been proved almost definitely in other Cephalopods. The basal cell is small and short, with an ill-defined outline, and

lies direct on the basement membrane. It distributes itself as sparse as in the ordinary part and no direct connection with the mechanism seems to be discernable.

The columnar cell, being the chief constituent of the organ, is, perhaps, most profoundly connected with the mechanism. It is very high, rich in plasm, tightly packed together with other cells of the same kind into a bundle, and its nucleus is without exception elliptical and poor in chromatin substance. The cytoplasm is thickly laden with fine granules, which coalesce almost into a nearly homogenous substance in the distal end of the cell. The granulation is probably made ready for the secretion of some sticky substance, by means of which the animal can adhere to foreign objects. This may be satisfactorily proved by the following facts: 1) The cell is found only in the organ and in no other part: 2) The cell shows stages of development as well as of decay after the secretion as is often the case in some kind of gland cells; and 3) The cell full of the substance is always at elevated parts with which the organ is actually applied to the object, while that empty of the

substance is found at the notches already referred to, the formation of which is doubtless due to the shrinkage of the cell.

Among the columnar cells mentioned above and held between their distal parts, there are found a few interstitial cells which I have referred to previously under the name of "fusiform cell", I take them to be sensory in nature though the testing by means of either Golgi's or methyleneblue method was not availed by me on this occasion. They are nearly fusiform as the name shows, and produce a short process distally and a long fiber proximally. The distal process clearly reaches the external surface of the integument, and the proximal fiber could often be traced to near the basement membrane as is often met with in cutaneous sensory cells. The cell body is itself very small, short, and provided with a roundish nucleus at the centre, so that it is easily distinguishable from the large columnar cell with an elliptical nucleus.

In view of the structure of the organ described above, its adhering mechanism may be surmised as follows: When the back of the animal comes in contact with the under surface of the fronds of the plant, the fusiform cells found there are firstly stimulated, which causes in turn the secretion of the sticky substance of the columnar cell, resulting in the adhesion of the animal, a mechanism much resembling that mentioned in *Hydra*¹⁾ and young tadpoles²⁾.

The adhering habit is quite unique among Cephalopods so far as is known. As to its significance, there may be two possibilities: the reproduction especially relating to the egg-laying, and the protective, that is sheltering from enemies on the one hand and lying in wait for its prey, which consists of microcrustaceans and fish larvae, on the other. But the latter i. e. the protection is more likely to be the true explanation owing to the before mentioned fact than the adhesive organ exists in both the male and female as well as in the young and adult.

1) Schneider, Arch. micr. Anat. XXXV, p. 330, pl. 35, figs 8, 9.

2) Ryder, Am. Nat. XXII, p. 263.

Lastly, a brief note is appended as to the taxonomy and distribution of the species. As I have already pointed out¹⁾, the Japanese form differs in several points from the original description of the species²⁾. This has been the case in all the specimens examined by me so that I am greatly inclined to follow the opinion offered by Berry in keeping them distinct, and applying Ortmann's specific name *paradoxa* to the Japanese form³⁾.

The localities recorded and new to our knowledge are as follows: Kadsiyama (Ortmann)⁴⁾, Misaki (Sasaki), Inland Sea (Sasaki), Hakodate (Sasaki)⁵⁾, Onomichi (!), Ise Province (!), Oki Is. (!), Sado Is. (!), and Oshoro (!). These localities are all in Japan and cover both the eastern and western sides of Honshu and the south-western coast of Hokkaido.

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- 1) Sasaki, Annot. Zool. Japonens, VIII, p. 599.
 - 2) Steenstrup, K. D. Vid. Selsk. Skr. (6), 1. p. 219, pl. 1, fig. 11-22.
 - 3) Berry, Rec. South Aust. Mus. I, (4), pp. 358, 359.
 - 4) Ortmann, Zool. Jahrb., Syst., III. p. 649, pl. 22. fig. 4.
 - 5) Sasaki, Proc. U. S. Nat. Mus. Vol. 57, p. 191.